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(72) Inventor: Fumagalli, Silvano  
I-20052 Monza, (Milano) (IT)

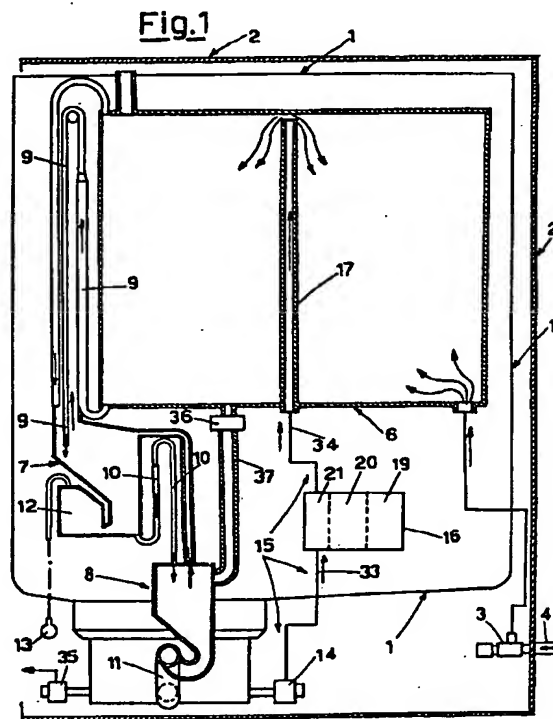
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(74) Representative: Mittler, Enrico et al  
I-20131 Milano (IT)

(71) Applicant: CANDY S.p.A.  
I-20052 Monza (Milano) (IT)

(54) Device for recovering and storing washing liquid in dishwashers, washing machines and the like

(57) A device for recovering and storing washing liquid in a washing machine comprises a recovery tank (6) housed inside the washing machine, a circuit (15) for transferring the washing liquid from a washing tub (1) of the washing machine to the recovery tank (6), which can be actuated at the end of the final rinsing phase of a washing cycle, and a container (16) for detergent with differentiated compartments comprising a first larger compartment (20) and a second smaller compartment (21) having total capacity equal to the quantity of detergent required for a washing cycle of the washing machine; the second smaller compartment is inserted in the transfer circuit (15) so that the liquid coming from the washing tub (1) is combined with detergent before being transferred into said recovery tank (6).



EP 0 691 099 A2

## Description

The present invention relates to a device for recovering and storing washing liquid in dishwashers, washing machines and the like.

The need to reduce the consumption of water used by dishwashers, washing machines and the like during one of their washing cycles is known.

For this purpose, and by virtue of the fact that a typical washing cycle substantially consists of a washing phase, followed by one or more rinsing phases, a solution has been proposed for washing machines aiming at storing the relatively clean water used during the final rinsing phase in order to reuse it in the washing phase of a subsequent cycle, it not being essential for the water used in this phase to be absolutely clean (in the sense of "drinkable").

To this end, it is necessary to provide a recovery tank wherein the water used during the final phase of rinsing, instead of being discharged, is sent to be stored until the subsequent washing cycle. This tank must have a capacity equal to the volume of water fed by the washing machine to perform rinsing, and must preferably be built into the household appliance, so as to avoid problems of housing in the spaces normally provided in laundry rooms.

Recovery of the water used during the final phase of rinsing also means a saving of electrical energy for heating during the subsequent washing cycle. The water stored in the recovery tank is in fact at a temperature (room temperature of 20-22°C) which is on average 6-8°C higher than that of the water coming from the water supply system.

The problem lies in the fact that the water recovered from the final phase of rinsing is in any case contaminated, and cannot be stored indefinitely without giving rise to unpleasant smells.

In view of the state of the art described, the object of the present invention is to provide a device for recovering and storing the washing liquid of a dishwasher, washing machine or the like, which is not affected by the aforementioned problem.

In accordance with the present invention, this object is achieved thanks to a device for the recovery and storage of the washing liquid in a washing machine, comprising a recovery tank housed inside the washing machine and a circuit for transferring the washing liquid from a washing tub of the washing machine to the recovery tank, which can be actuated at the end of the final phase of rinsing of a washing cycle, characterised in that it also comprises a container of detergent with differentiated compartments comprising a first larger compartment and a second smaller compartment having a total capacity equal to the quantity of detergent required for a washing cycle of the washing machine, said second smaller compartment being inserted in the transfer circuit so that the liquid coming from the washing tub can be combined with detergent before being transferred to said recovery tank.

Thanks to a device according to the present invention, the washing liquid recovered after the final rinsing phase of a washing cycle can be stored in the recovery tank for long periods, even months, since the addition of detergent greatly increases preservation by acting as a disinfectant.

These and other features of the present invention will be made clearer by the following detailed description of one of its embodiments, illustrated by way of a non-limiting example in the accompanying drawings, in which:

Figure 1 shows, sectioned along a vertical plane, a washing machine fitted with a device according to the present invention;

Figure 2 is a view sectioned along a horizontal plane of the machine in Figure 1;

Figure 3 shows in a plan view the detail of a part of a door of the washing machine wherein a compartmentalised detergent container is housed according to the present invention;

Figure 4 shows said compartmentalised detergent container sectioned along the vertical plane IV-IV of Figure 2, but with the door open.

The following description is given only as an example of a possible embodiment of the present invention. In this example it is assumed that the machine is a dishwasher.

With reference to Figure 1, a dishwasher comprises a washing tub 1 housed inside a frame 2 forming the external casing of the dishwasher. Mounted on said frame 2 is a feed solenoid valve 3 whereto a pipe 4 for feeding clean water is connected externally.

The base of the washing tub 1 converges towards a collection basin or sump 5, whereto are connected a drain pump 35, which can be actuated to discharge the water contained in the washing tub 1, and a pump (not shown) for feeding spraying rotors which are placed in a manner in itself known inside the washing tub 1.

The dishwasher is equipped with a device for controlling the volume of water fed, substantially of the type described in the Italian patent Application no. MI94A000353 in the name of the same Applicant. This control device comprises a tank 6 with capacity equal to the volume of water required by the dishwasher in one single feed operation during a washing cycle (5 litres in the case of a dishwasher for twelve table settings), a first transfer recipient 7 and a second transfer recipient 8. The tank 6, the first transfer recipient 7 and the second transfer recipient 8 are connected in cascade by siphon pipes 9 and 10. The second transfer recipient 8 is connected to the sump 5 by means of a hose bent to form a further siphon 11. The tank 6 is operatively connected to the feed solenoid valve 3, via a statutory air break device and a decalcification assembly (not shown in that known).

The first transfer recipient 7 comprises a pressure chamber 12 whereto a pressure switch 13 is connected. The pressure switch 13 is connected to a programming

device (timer) for controlling the sequence of the phases of a washing cycle. The programming device commands the opening and closure of the feed solenoid valve 3, actuation of the pump for feeding the spraying rotors and actuation of the drain pump 35.

The siphon pipe 9 leads into the base of the tank 6 and to the top of the first transfer recipient 7, placed at a lower height from the ground in relation to the base of the tank 6. The siphon pipe 10 leads into the base of the first transfer recipient 7 and the top of the second transfer recipient 8, placed at a lower height from the ground in relation to the base of the first transfer recipient 7. The siphon pipe 9 triggers automatically when the tank 6 has been filled, and de-triggers when the tank 6 has been emptied. The siphon pipe 10 triggers when the first transfer recipient 7 has been filled with water coming from the tank 6, and de-triggers when the first transfer recipient 7 has been emptied. Subsequently the siphon pipes 9 and 10 cause, once triggered, transfer of all the water contained in the tank 6 into the sump 5, and hence into the washing tub 1. Before the siphon pipe 10 triggers, the pressure of air in the pressure chamber 12 causes triggering of the pressure switch 13 which signals to the programming device to close the feed solenoid valve 3. In other words, when the tank 6 has been filled (i.e. when 5 litres of water have been fed), transfer of water into the first transfer recipient 7 begins, where the increase in pressure consequent to the rise in the level of the water causes triggering of the pressure switch 13, and consequently closure of the solenoid valve 3.

The device for recovering and storing the water used in the final rinsing phase of a washing cycle uses the tank 6 as a recovery tank (obviously this is only made possible in the case wherein the dishwasher is equipped with the feed control device described; otherwise it is necessary to provide a specific recovery tank), and substantially comprises a recovery pump 14 connected to the sump 5 and to a transfer circuit 15 for transferring water from the sump 5 to the tank 6. As shown schematically in Figure 1, a detergent container 16, which is to be described hereinbelow, also forms part of the transfer circuit 15. The transfer circuit 15 also comprises a substantially vertical conduit 17 which develops inside the tank 6, and whose end opening is positioned approximately at the top of the tank 6 itself.

Figure 2 is a section of the dishwasher along a horizontal plane, wherein a door 18 for access to the washing tub 1 can be seen. The detergent container 16 is housed in a manner in itself known on the internal wall 40 of the door 18. As can be seen better in Figure 3, which shows in a front view the part of the door 18 wherein the detergent container 16 is housed, the latter comprises substantially three separate compartments 19, 20 and 21. Each compartment is fitted with a respective cover 22, 23 and 24 hinged onto the container 16. The covers 23 and 24 are elastically forced by respective springs (not visible) into the opening position shown in Figure 3. Two closure devices 38 and 39 allow the covers 23 and 24 to be locked in the closure position. A first com-

partment 19 is for containing products such as polishing agents. A second compartment 20 is for containing a detergent to be used during washing of dishes. A third compartment 21, situated at the end of the container 16 closest to a lateral vertical wall 25 of the washing tub 1, is also for containing detergent. The total capacity of the compartments 20 and 21 is equal to the quantity of detergent required for washing a load of twelve table settings (typically 30 g), but the compartment 21 has a smaller capacity (for example 10 g) compared to the compartment 20.

Two elbow conduits 26 and 27 are connected to the compartment 21 and extend into the washing tub 1. When the door 18 is closed, the conduits 26 and 27 are joined to two respective conduits 28 and 29 on each of which respective external rubber bellows seals 41 and 42 are fitted. The two conduits 28 and 29 lead into two separate chambers 30 and 31 of a recipient 32 mounted on the wall 25 of the washing tub 1. Respective pipes 33 and 34 are also connected to each of the chambers 30 and 31. The pipe 33 leads from the recovery pump 14, while the pipe 34 is connected to the conduit 17.

A typical washing cycle of a dishwasher consists of a washing phase, followed by one or more rinsing phases. Each of these phases corresponds to a water feed operation (5 litres in the case of washing of twelve table settings), performed under the control of the control device described previously. Between one phase of the cycle and the next, before a fresh feed of water, the drain pump 35 is actuated to discharge the water contained in the washing tub 1. At the end of the final rinsing phase however, the drain pump 35 is not actuated, and the recovery pump 14 is instead started up. The water contained in the washing tub 1 is sent into the circuit 15, then passes into the compartment 21 of the detergent container 16 where it is combined with detergent, and from here is sent through the conduit 17 into the tank 6, wherein it is stored until the subsequent washing cycle. The quantity of water which can effectively be recovered is not 5 litres, since at a certain point the recovery pump 14 starts cavitation. It has been demonstrated in experiments that the quantity of water which can actually be recovered is approximately 4.7 litres; the remaining 0.3 litre is left in the sump 5.

When the user starts up a subsequent washing cycle, after filling the compartments of the detergent container 16, the feed solenoid valve 3 is opened to allow feeding into the tank 6 of the quantity of water required for reaching the 5 litres. At this point the siphon pipe 9 triggers, as described previously, and the pressure switch 13 signals to the programming device that the tank 6 has been filled. The programming device closes the solenoid valve 3. The main washing phase then starts: a cam (not shown), actuated by the programming device, acts on the closure device 38 in order to release the cover 23 of the compartment 20, which is automatically opened, so that the water spread by the spraying rotors can load and mix with the detergent contained therein. The 20 g of detergent contained in the compartment 20

are added to the 10 g already mixed in the water contained in the tank 6 to obtain the quantity of 30 g of detergent normally required for washing twelve table settings.

The washing cycle then continues in the customary manner, until it reaches the final rinsing phase.

The device according to the present invention may also comprise a timed system of automatic discharge of the water contained in the recovery tank 6. For this purpose, as shown in Figure 1, the tank 6 is connected, by means of a solenoid valve 36 and a conduit 37, to the second transfer recipient 8, and hence to the sump 5. The dishwasher must also comprise a delay device of the "start delay" or "RTT" type, for example mounted on the same programming device. The solenoid valve 36 is normally closed, but is opened by the delay device after a preset length of time has passed (for example 36 hours) from the end of the last washing cycle. This length of time can also be set by the user.

It is also possible to provide a manual selector switch for de-actuating the function of water recovery. In this case, in the subsequent washing cycle, it will be necessary to feed the 5 litres of water. During the main washing phase, the aforementioned cam also actuates opening of the cover 24, so that all the 30 g of detergent are mixed with the washing water.

The device according to the present invention can be installed on dishwashers fitted with a control device which allows feeding of differentiated volumes of water, for washing loads of twelve or six table settings alternately, of the type described in the Italian patent Application no. MI94/A001078, in the name of the same Applicant.

Although the device according to the present invention has been described with reference to a dishwasher, it may be used on washing machines.

## Claims

1. Device for recovering and storing washing liquid in a washing machine, comprising a recovery tank (6) housed inside the washing machine, and a circuit (15) for transferring the washing liquid from a washing tub (1) of the washing machine to the recovery tank (6), which can be actuated at the end of the final phase of rinsing of a washing cycle, characterised in that it also comprises a detergent container (16) with differentiated compartments comprising a first larger compartment (20) and a second smaller compartment (21) having a total capacity equal to the quantity of detergent required for a washing cycle of the washing machine, said second smaller compartment being inserted in the transfer circuit (15) so that the liquid coming from the washing tub (1) is combined with detergent before being transferred into said recovery tank (6).
2. Device for recovery and storage according to claim 1, characterised in that it also comprises means (35-

37) which can be timed and actuated to cause discharge of the liquid stored in the recovery tank (6).

3. Device according to claim 2, characterised in that said means (35-37) comprise valve means (36) connected to the recovery tank (6), and a timer for commanding actuation of said valve means (36) after a predetermined length of time from the end of the last washing cycle.
4. Device according to claim 1, characterised in that said recovery tank (6) coincides with a tank of a device for controlling the volume of washing liquid fed into the washing tub (1) in a feed phase of the washing cycle.
5. Recovery device according to claim 1, characterised in that said transfer circuit (15) comprises a pump (14).
6. Recovery and storage device according to claim 2, characterised in that the detergent container (16) is mounted on a door (18) for access to the washing tub (1), said second smaller compartment (21) being connected to two conduits (26,27) for entrance of the liquid coming from the pump (14) and exit of the liquid to be transferred into the recovery tank (6) respectively.

Fig.1

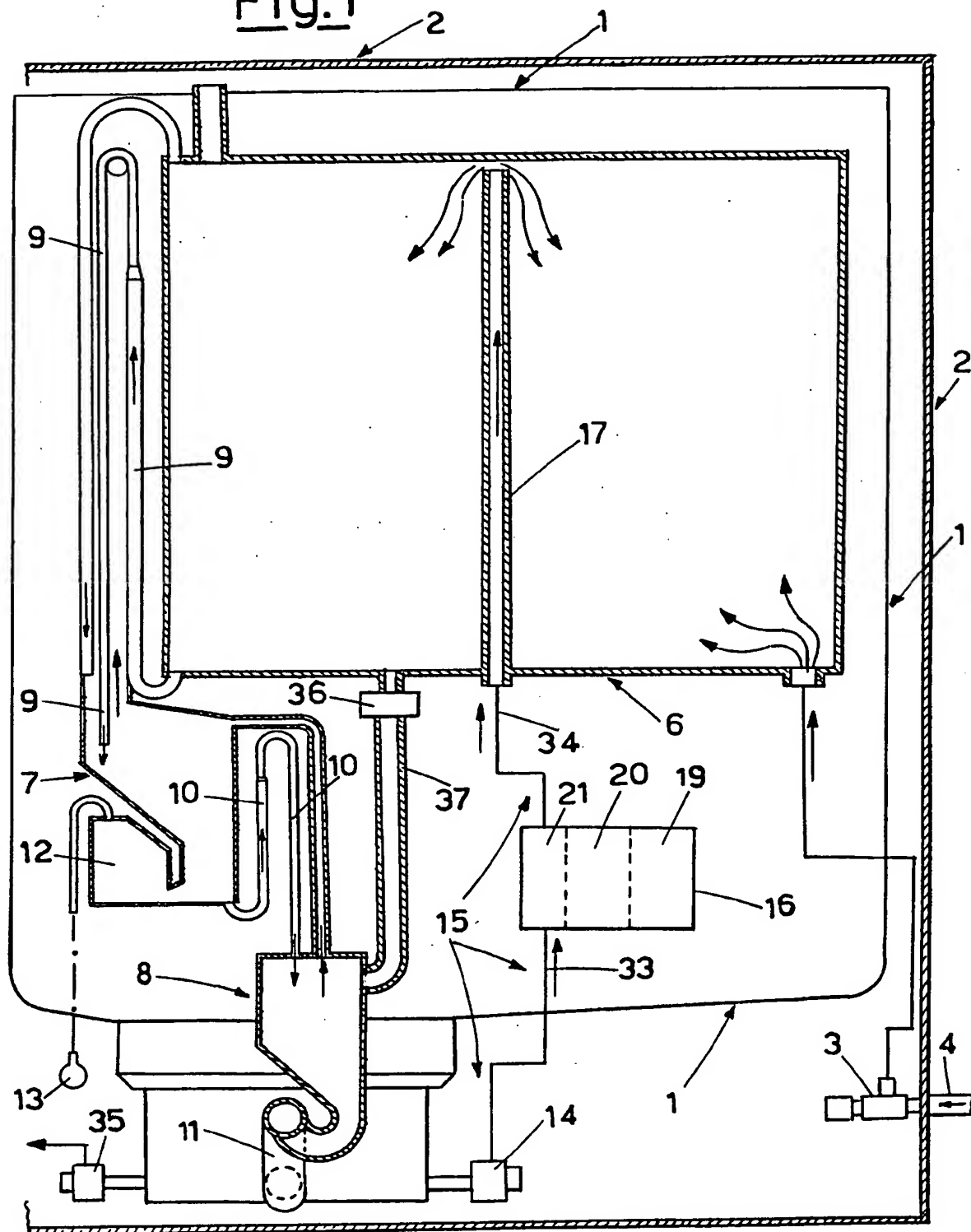


Fig.2

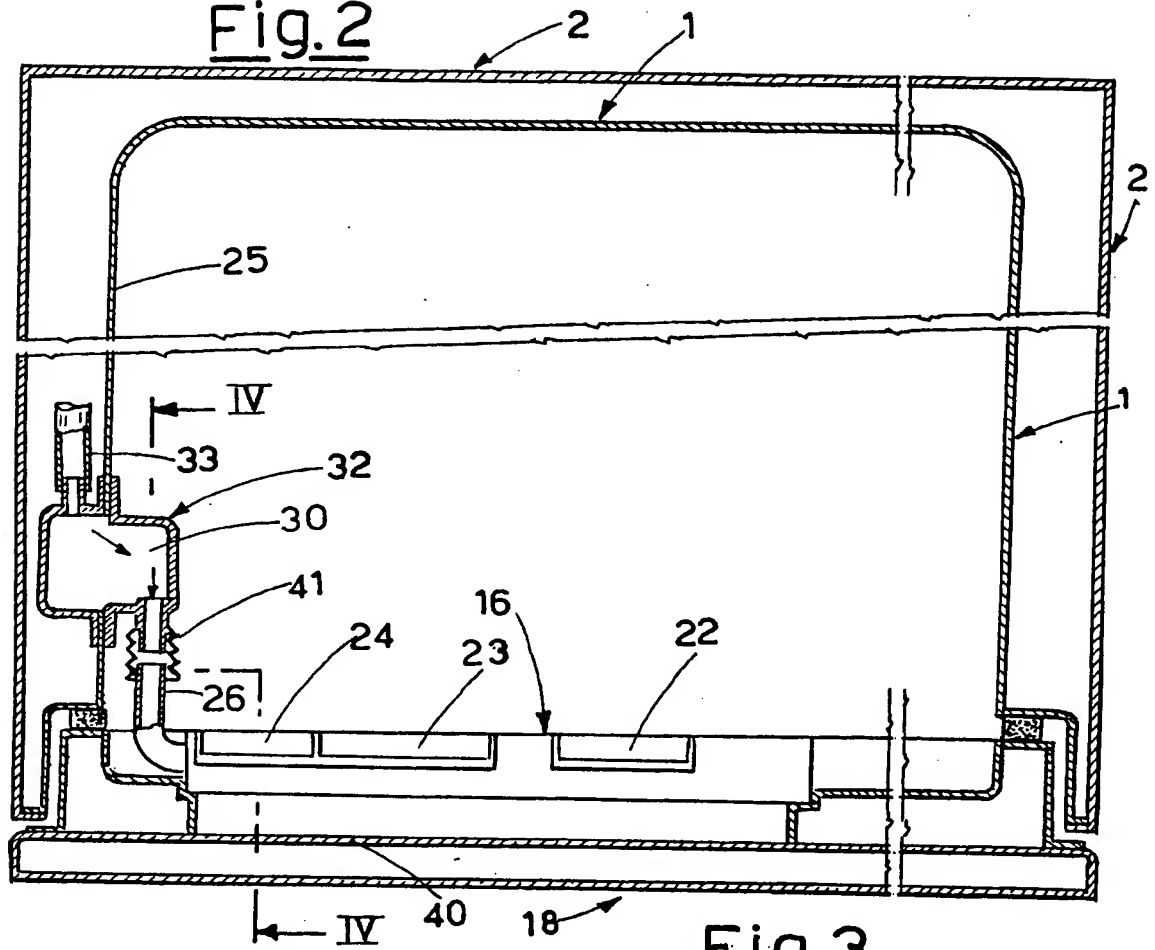
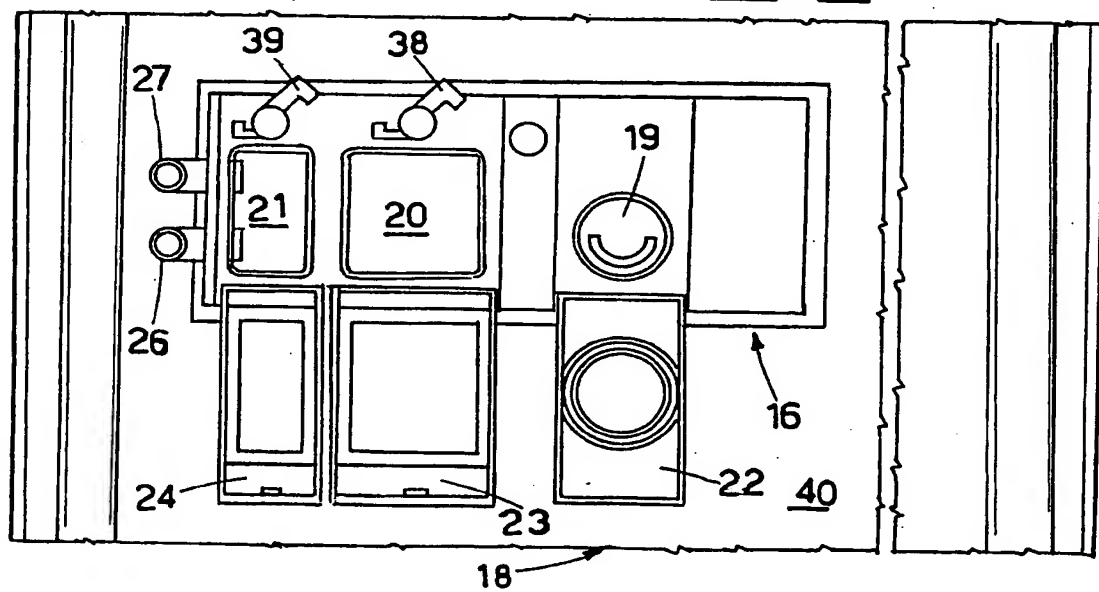
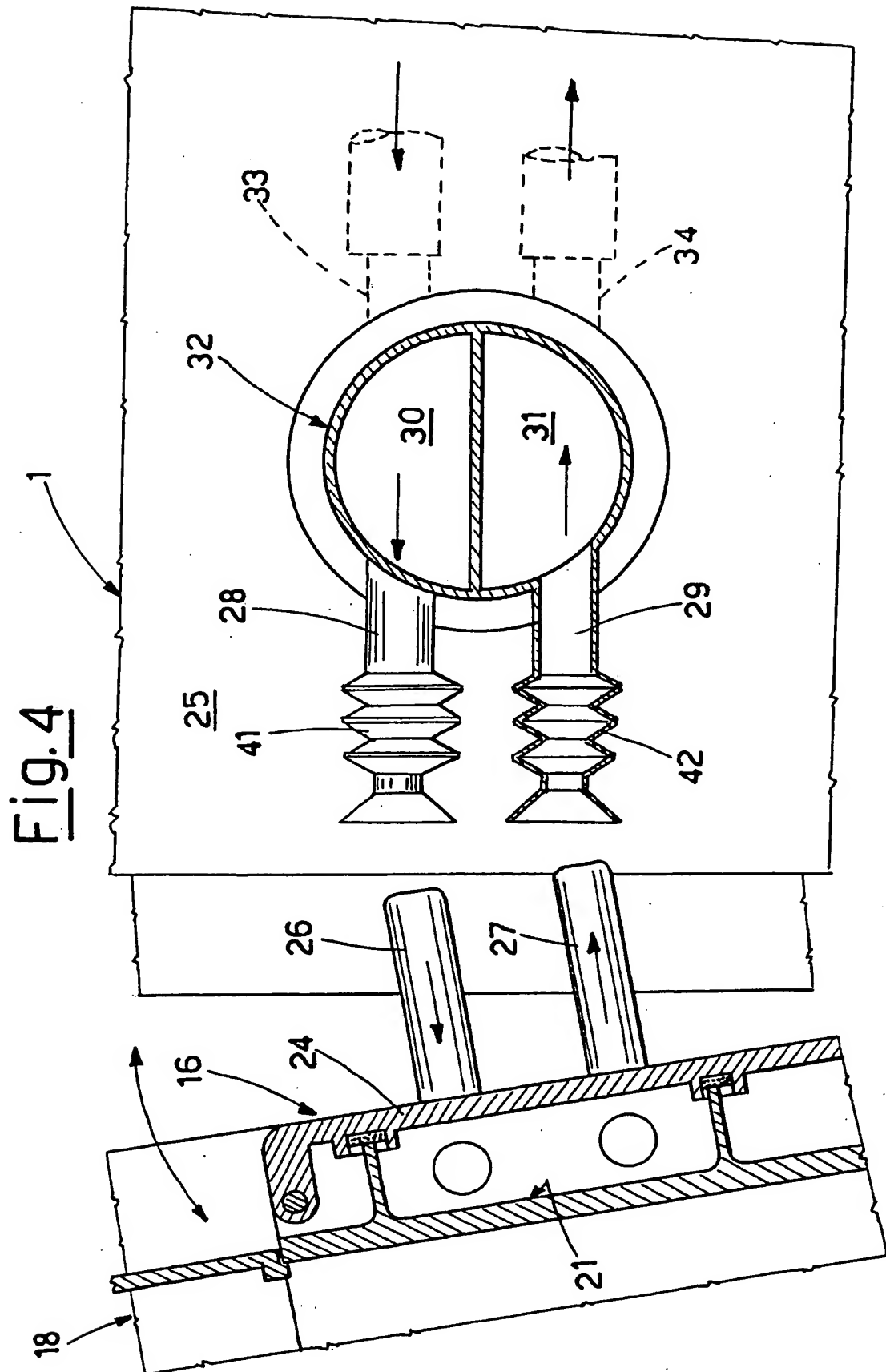


Fig.3









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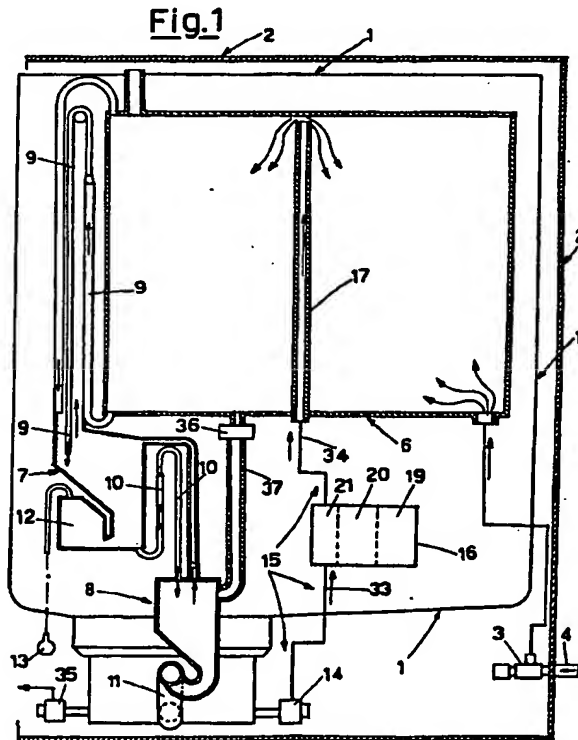
(71) Applicant: CANDY S.p.A.  
I-20052 Monza (Milano) (IT)

(72) Inventor: Fumagalli, Silvano  
I-20052 Monza, (Milano) (IT)

(74) Representative:  
Mittler, Enrico et al  
c/o Mittler & C. s.r.l.,  
Viale Lombardia, 20  
20131 Milano (IT)

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EP 0 691 099 A3



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# EUROPEAN SEARCH REPORT

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EP 95 20 1702

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 40 04 057 A (MIELE & CIE) 14 August 1991 * column 3, line 19 - line 60 * * column 5, line 19 - line 29; figure 3 *	1-5	A47L15/00 D06F39/00 A47L15/42
A	DE 39 36 989 A (SCHWARZENBERG WASCHGERAETE) 17 May 1990 * column 2, line 13 - column 3, line 50; figure 1 *	1,4	
A	DE 29 10 140 A (WFK TESTGEWEBE GMBH) 25 September 1980 * page 8, line 15 - page 9, line 8 * * page 10, line 22 - line 26 * * page 12, line 13 - line 19 * * page 13, line 1 - line 4 * * figure 3 *	1-3,5	
A	US 3 841 116 A (KLEIN L ET AL) 15 October 1974 * column 4, line 38 - line 56 * * column 7, line 19 - line 32 * * figures 1A-B *	1-3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D06F A47L
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>4 June 1998</b>	Examiner <b>Norman, P</b>
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

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